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#4

PATENT
450110-03714

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Morgan William Amos DAVID
Serial No.	:	10/014,148
Filed	:	December 4, 2001
For	:	VIDEO PROCESSING AND/OR RECORDING
Art Unit	:	2651

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Gordon Kessler, Reg. No. 38,511
Name of Applicant, Assignee or Registered Representative

Signature

March 15, 2002
Date of Signature

CLAIM OF PRIORITY

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

In support of the claim of priority under 35. U.S.C. § 119 asserted in the Declaration accompanying the above-entitled application, as filed, please find enclosed herewith certified copies of U.K. Application Nos. 0008410.3 and 0008407.9, filed in U.K. on 5 April 2000 and 5 April 2000, respectively, forming the basis for such claim.

PATENT
450110-03714

Acknowledgment of the claim of priority and of the receipt of said certified copy(s) is requested.

Respectfully submitted,

FROMMER LAWRENCE & HAUG LLP
Attorneys for Applicant

By: _____
Gordon Kessler
Reg. No. 38,511
Tel. (212) 588-0800

Enclosure(s)

The Patent Office

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation and Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein together with the Statement of inventorship and of right to grant of a Patent (Form 7/77) which was subsequently filed.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

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Signed J Evans

Dated 18 December 2001

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

06APR00 E527469-13 D02246
P01/7700 0.00-0008410.3

D Y & CO

Request for a grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference — P/8794.GB

0008410.3

2. Patent application number
(The Patent Office will fill in this part) — - 5 APR 2000

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

SONY UNITED KINGDOM LIMITED
THE HEIGHTS
BROOKLANDS
WEYBRIDGE
SURREY, KT13 0XW

Patents ADP number *(if you know it)* 6522700001

If the applicant is a corporate body, give the country/state of its incorporation — UNITED KINGDOM

4. Title of the invention — DIGITAL VIDEO TAPE RECORDING

5. Name of your agent *(if you have one)* — D YOUNG & CO

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

21 NEW FETTER LANE
LONDON
EC4A 1DA

Patents ADP number *(if you have one)* — 59006

6. If you are declaring priority from one or more earlier patent applications, give the country and date of filing of the or each of these earlier applications and (if you know it) the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day/month/year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and filing date of the earlier application

Number of earlier application	Date of filing *(day/month/year)*

8. **Is a statement of inventorship and of right to grant of a patent required in support of this request?** *(Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

9. **Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document**

Continuation sheets of this form	0
Description	5
Claims(s)	3
Abstract	1
Drawing(s)	3 ~~3~~ 4

10. **If you are also filing any of the following, state how many against each item.**

Priority documents	0
Translations of priority documents	0
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	0
Request for preliminary examination and search *(Patents Form 9/77)*	1
Request for substantive examination *(Patents Form 10/77)*	0
Any other documents *(please specify)*	A Copy of GB 9927111.6

11. **I/We request the grant of a patent on the basis of this application.**

Signature D Young & Co — **Date** 05 04 00

D YOUNG & CO
Agents for the Applicants

12. **Name and daytime telephone number of the person to contact in the United Kingdom** — J A TURNER — (02380) 634816

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After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

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Patents Form 7/77

Patents Act 1977
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The Patent Office

D Y & CO

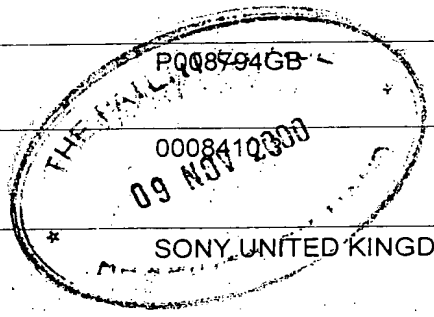
Statement of inventorship and of right to grant of a patent

The Patent Office

Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference — P008794GB

2. Patent application number *(if you know it)* — 0008410.300



3. Full name of the or of each applicant — SONY UNITED KINGDOM LIMITED

4. Title of the invention — DIGITAL VIDEO TAPE RECORDING

5. State how the applicant*(s)* derived the right from the inventor*(s)* to be granted a patent — BY VIRTUE OF AN ASSIGNMENT DATED 3 NOVEMBER 2000 BETWEEN OURSELVES AND THE OVERNAMED INVENTOR

6. How many, if any, additional Patents Forms 7/77 are attached to this form? *(see note (c))*

7. **I/We believe that the person*(s)* named over the page *(and on any extra copies of this forms)* is/are the inventor*(s)* of the invention which the above patent relates to.**

Signature — Date

D Young & Co

D YOUNG & CO — 6 Nov 2000
Agents for the Applicants

8. Name and daytime telephone number of person to contact in the United Kingdom — 023 80634816 — James Turner

Notes

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b) Write answers in capital letters using black ink or you may type them.

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355252 JS 30

D Young & Co ref: P008794GB

Enter the full names, addresses and postcodes of the inventors in the boxes and underline the surnames

Surname	DAVID
First Names	Morgan William Amos
Address	18 Broomleaf Road Farnham Surrey, GU9 8DG United Kingdom

Patents ADP number (if you know it): 06227342001

Surname	
First Names	
Address	

Patents ADP number (if you know it):

Surname	
First Names	
Address	

Patents ADP number (if you know it):

Reminder:
Have you signed the form?

DIGITAL VIDEO TAPE RECORDING

This invention relates to digital video tape recording.

Several formats of digital video tape have been proposed. The first commercially successful format was the so-called "D1" format, described in the book, "Introduction to the 4:2:2 Digital Video Tape Recorder", Gregory, Pentech Press, 1988. Since then there have been many other formats, either standardised or proprietary.

A feature that these formats have in common is the use of helical scanning. This is a well-established technique in which the tape medium is wrapped at least part of the way around a head drum. One or more rotating read/write heads, mounted on the head drum, sweep out successive slant tracks on the tape medium as the medium is progressed slowly past the head drum. Linear tracks may also be used to carry information such as linear time code, other control information, a cueing audio track and the like.

Each slant track is generally divided up into a number of regions or sectors. Although the precise number and layout of these regions varies from format to format, there are generally one or more video sectors and one or more audio sectors on each slant track. These can store compressed or uncompressed video and audio data. In other systems, data representing each video frame or image, or a group of images, may be recorded onto a group of tracks.

An example of a tape format is shown schematically in Figure 1 of the accompanying drawings. On the tape 10 there are three linear tracks disposed towards the tape edges: a linear time code track 20, a control track 30 and a cue audio track 40. Each slant track 50 has a predetermined layout of data sectors: two video sectors 60, 70 and four audio sectors A1..A4, each separated by a small gap 80 in the head scanning direction. The audio sectors A1..A4 correspond to four audio recording tracks or channels.

Recently, interest has developed in ways of recording so-called metadata along with the audio and video material. Metadata is additional or accompanying data defining the audio/video material in some fashion, and can include data items such as material identifiers (e.g. the SMPTE Unique Material Identifier or UMID), bibliographic data such as cast or staff lists, copyright information, equipment used and so on. Of course, if any such metadata is to be stored alongside the audio/video material on tape, some data capacity needs to be allocated for its storage.

One previously proposed solution is to store "small" metadata items using the "user bits", that is a small amount of user-definable data within the vertical interval time code (VITC) or linear time code (LTC) areas of the tape. Typically the user bits provide only of the order of 4 bytes (32 bits) per frame, of which some capacity is taken up by existing schemes such as "good shot markers" (GSMs). As an SMPTE UMID occupies at least 32 bytes, and in some forms up to 64 bytes, this solution provides for only a limited storage of this data.

This invention provides a digital video tape recorder operable to record successive slant tracks, each comprising a number of sectors, on a tape medium, in which, across a group of one or more slant tracks:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

The invention recognises that previous attempts to store metadata along with the audio/video material on tape have either suffered from a very low capacity or a difficulty in modifying the metadata later. Modification of the metadata at a later stage is important because extra details may need to be added or some details (such as copyright ownership) may indeed change if the programme is sold or licensed to other parties.

The invention provides a dedicated sector or sectors – perhaps one or more per slant track or one or more in a group of slant tracks – to store metadata. This allows more flexibility in allocating data capacity to the metadata and also, because the sector is separate, the ability to read, write or modify the metadata sectors independently of the audio/video material.

It is considered counter-intuitive to add a further sector for the following reason. The sectors have a small gap 80 between them in the head scanning direction. The gap length corresponds to the distance moved by the heads during the time taken to switch the record current on or off, plus a margin of safety. This is important to allow independent later modification of the content of a sector without affecting the content of neighbouring or other sectors on the same slant track. The gaps 80 are kept to the minimum possible length to avoid wasting tape capacity – wherever there is a gap, data cannot be stored. So, the addition of another sector for metadata means a loss of some data capacity for the helical scanning tracks. However, the invention involves the realisation that this

perceived disadvantage actually leads to the advantageous ability to modify the metadata later independently of the audio/video content.

In preferred embodiments, each slant track recorded by the recorder comprises:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

In one embodiment, the independently writeable sector(s) storing metadata have a predetermined data capacity per slant track. This has the advantage that the start and end positions of the metadata sector(s) can be predetermined, allowing location or modification of the metadata to be made in a straightforward manner.

In another embodiment, the recorder is operable to vary the extent of the metadata sector(s) in response to the amount of metadata associated with each time segment (e.g. a field or frame) of the video and/or audio material. This avoids wasting tape capacity on empty or poorly filled metadata sectors, and can be achieved by, for example, varying the degree of quantisation of the video data in a compressed system.

In order to facilitate the location by the recorder of the metadata sector(s), it is preferred that the recorder comprises means for recording control data onto the tape indicating the extent of the metadata sector(s) of at least each slant track carrying one or more metadata sectors. Preferably the control data is recorded at a position on the tape so that, in a normal replay direction, the control data relating to a slant track is recovered from the tape before the head traverses a metadata sector of that slant track. This allows the control data defining the position of the metadata sector(s) to be obtained before the head even reaches those sector(s).

Preferably the recorder is arranged to record four concurrent audio channels on the tape medium.

Further respective aspects and features of the invention are defined in the appended claims.

Embodiments of the invention will now be described with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Figure 1 is a schematic diagram illustrating a previously proposed tape format;

Figure 2 is a schematic diagram schematically illustrating a tape format according to an embodiment of the invention; and

Figure 3 schematically illustrates a tape recording/replay apparatus according to an embodiment of the invention.

Referring now to Figure 2, a tape medium 110 carries linear tracks 20, 30, 40 as before, along with successive slant tracks 150 having independently writeable sectors separated by gaps 80 in the head scanning direction.

In this example embodiment the sectors are as follows: a video sector 160 (optionally having header data 165 – see below), audio sectors A1..A4 representing four concurrent audio channels, a further video sector 170 and a metadata sector 180 storing at least the SMPTE UMID and other metadata such as production information, cast lists, copyright ownership, bibliographic data and the like.

The boundary between the sectors 170 and 180, that is to say (indirectly) their data capacities, can be predetermined for that tape format. However, in embodiments of the invention the boundary can be moveable in dependence on the amount of metadata to be stored, so that the available tape capacity is not wasted if the quantity of metadata is low.

In the case of a moveable boundary, data defining the boundary, or defining the size of some sectors so that the boundary position can be derived, could be stored in for example the metadata sector of a preceding track. Alternatively, it could be stored in the same track to which it refers, but further towards the start of the track in a head scanning direction. The header 165 could be used for this information in relation to the boundary between the sectors 170 and 180. In either of these example cases, in a normal replay direction the head traverses the relevant area defining the boundary position before it reaches the boundary itself. This allows the metadata sector to be located and, if desired, modified independently of the video and audio sectors.

Figure 3 schematically illustrates a tape recording/replay apparatus operable to write, read and/or edit tapes recorded to the tape format shown in Figure 2.

The apparatus of Figure 3 comprises a metadata buffer, an audio/video buffer 210, a control circuit 220, a compression/decompression device 230, a multiplexer 240, a tape recording/replay arrangement having a recording/replay head set 250 and a tape medium 260, and a metadata editor 270.

Recording onto Tape

Audio/video material is received and buffered in the A/V buffer 210, and metadata associated with the A/V material is buffered in the metadata buffer. The control circuit

220 detects the quantity of metadata – on a field-by-field basis, a frame-by-frame basis or as averaged over a particular number of fields or frames. In response to this detection, the control circuit controls the compression ratio or a compression parameter such as quantisation of the compression/decompression device 230 to compress the A/V data so as to allow space for the metadata. A lower limit on the amount of A/V data to be recorded can be set, in order to maintain quality. An example of a system in which the degree of compression is varied in response to the amount of metadata is given in GB9927111.6, a copy of which is placed on the file of the present application as a background document.

The metadata and compressed A/V data are passed to the multiplexer/demultiplexer 240 to be formatted into a data stream for recording on respective sectors of the tape medium 260. The control circuit 220 also controls the tape recording arrangement so that sector gaps 80 occur at the correct positions to record the respective amounts of metadata and A/V data.

Replay from Tape

Data replayed form the tape is passed to the multiplexer/demultiplexer 240 which separates metadata from A/V data. If control data defining the boundary between metadata and other sectors is recorded elsewhere (e.g. in the header 165) this can be separated off and passed to the control circuit 220. Otherwise, the control circuit could recover this information from the metadata sector of a preceding track, or wherever it had been stored.

The metadata is output via the metadata buffer. The A/V data is decompressed by the compression/decompression device and output via the A/V buffer.

Editing Metadata

If it is desired to edit only the metadata, then the metadata can be read from the tape, passed to a metadata editor (e.g. a computer terminal or apparatus running appropriate editing software) and then re-recorded back onto the tape as described above.

If a variable boundary arrangement is not used, so that the metadata sector has a fixed size and boundaries, then the arrangement of Figure 3 may be simplified in that the control circuit does not need to control the degree of compression of the compression/decompression device.

Of course, it is not necessary to have one metadata sector per track. Other embodiments could use more than one, or perhaps metadata sector(s) on only some tracks, for example in a repetitive fashion across a group of tracks.

CLAIMS

1. A digital video tape recorder operable to record successive slant tracks, each comprising a number of sectors, on a tape medium, in which, across a group of one or more slant tracks:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

2. A recorder according to claim 1, in which each slant track recorded by the recorder comprises:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

3. A recorder according to claim 1 or claim 2, in which the independently writeable sector(s) storing metadata have a predetermined data capacity per slant track.

4. A recorder according to claim 1 or claim 2, in which the recorder is operable to vary the extent of the metadata sector(s) in response to the amount of metadata associated with each time segment of the video and/or audio material.

5. A recorder according to claim 4, comprising means for recording control data onto the tape indicating the extent of the metadata sector(s) of at least each slant track carrying one or more metadata sectors.

6. A recorder according to claim 5, in which the control data is recorded at a position on the tape so that, in a normal replay direction, the control data relating to a slant track is recovered from the tape before the head traverses a metadata sector of that slant track.

7. A recorder according to any one of the preceding claims, the recorder being arranged to record four concurrent audio channels on the tape medium.

8. A tape format of successive slant tracks, each comprising a number of sectors, in which, across a group of one or more slant tracks:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

9. A tape medium having recorded thereon successive slant tracks, each comprising a number of sectors, in which, across a group of one or more slant tracks:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

10. An editing apparatus for use with a tape medium according to claim 9, the apparatus comprising means for reading, modifying and rewriting metadata stored in the metadata sector(s) of the slant tracks independently of the audio and video material stored in the audio and video sectors of the slant tracks.

11. A method of recording video material, audio material and associated metadata onto a tape medium, the method comprising the step of recording successive slant tracks, each comprising a number of sectors, in which, across a group of one or more slant tracks:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

12. A method of editing a tape medium according to claim 9, the method comprising the steps of reading, modifying and rewriting metadata stored in the metadata sector(s) of the slant tracks independently of the audio and video material stored in the audio and video sectors of the slant tracks.

13. A tape recorder substantially as hereinbefore described with reference to the accompanying drawings.

14. A tape format substantially as hereinbefore described with reference to the accompanying drawings.

15. A tape medium substantially as hereinbefore described with reference to the accompanying drawings.

16. A recording method substantially as hereinbefore described with reference to the accompanying drawings.

17. Editing apparatus substantially as hereinbefore described with reference to the accompanying drawings.

18. An editing method substantially as hereinbefore described with reference to the accompanying drawings.

ABSTRACT

DIGITAL VIDEO TAPE RECORDING

A tape medium has recorded thereon successive slant tracks, each comprising a number of sectors, in which, across a group of one or more slant tracks:

at least one independently writeable sector stores primarily video material;

at least one independently writeable sector stores primarily audio material; and

at least one independently writeable sector stores metadata associated with the audio and/or video material, the metadata including at least a material identifier and other data relating to the material.

Figure 2.

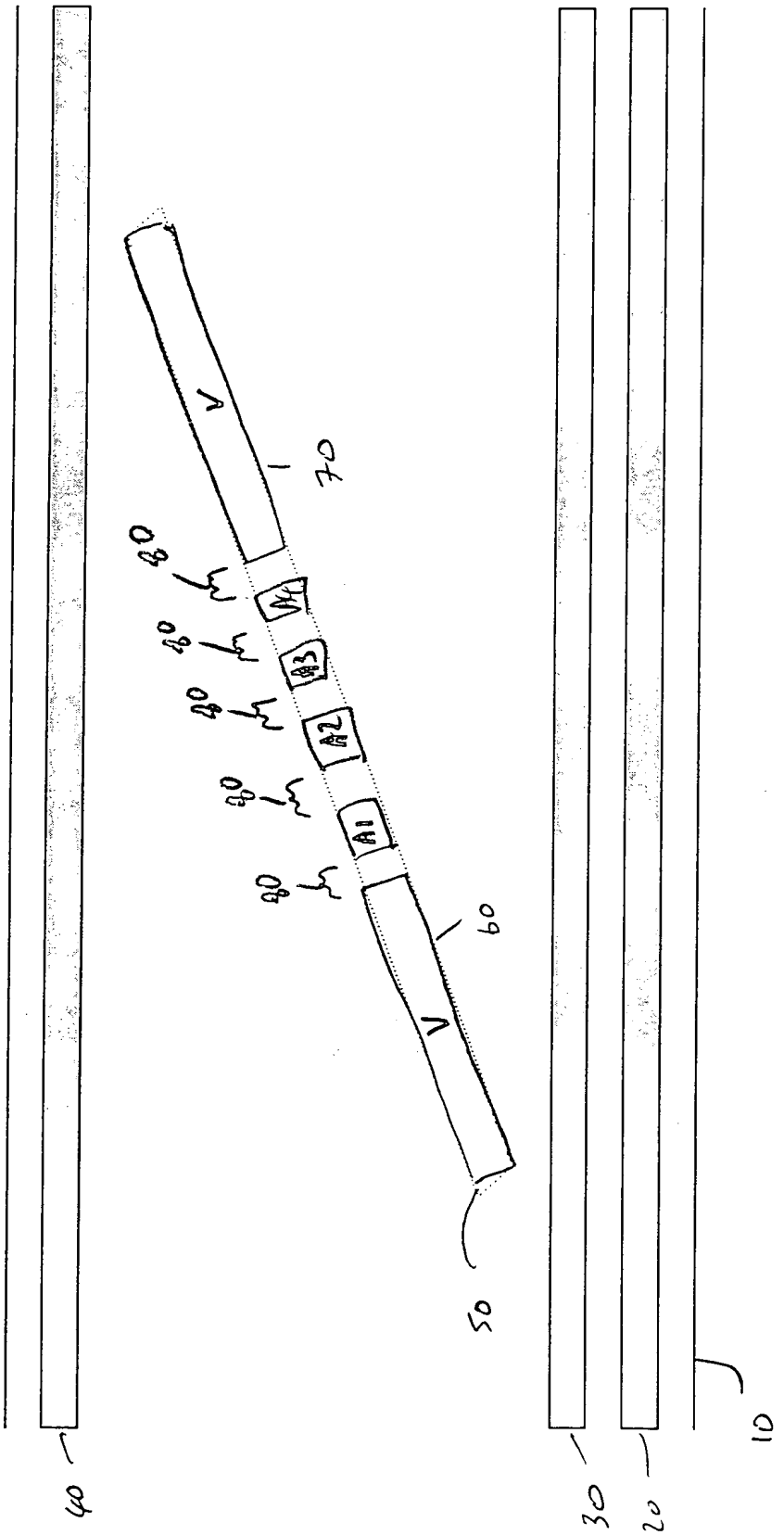

Fig. 1

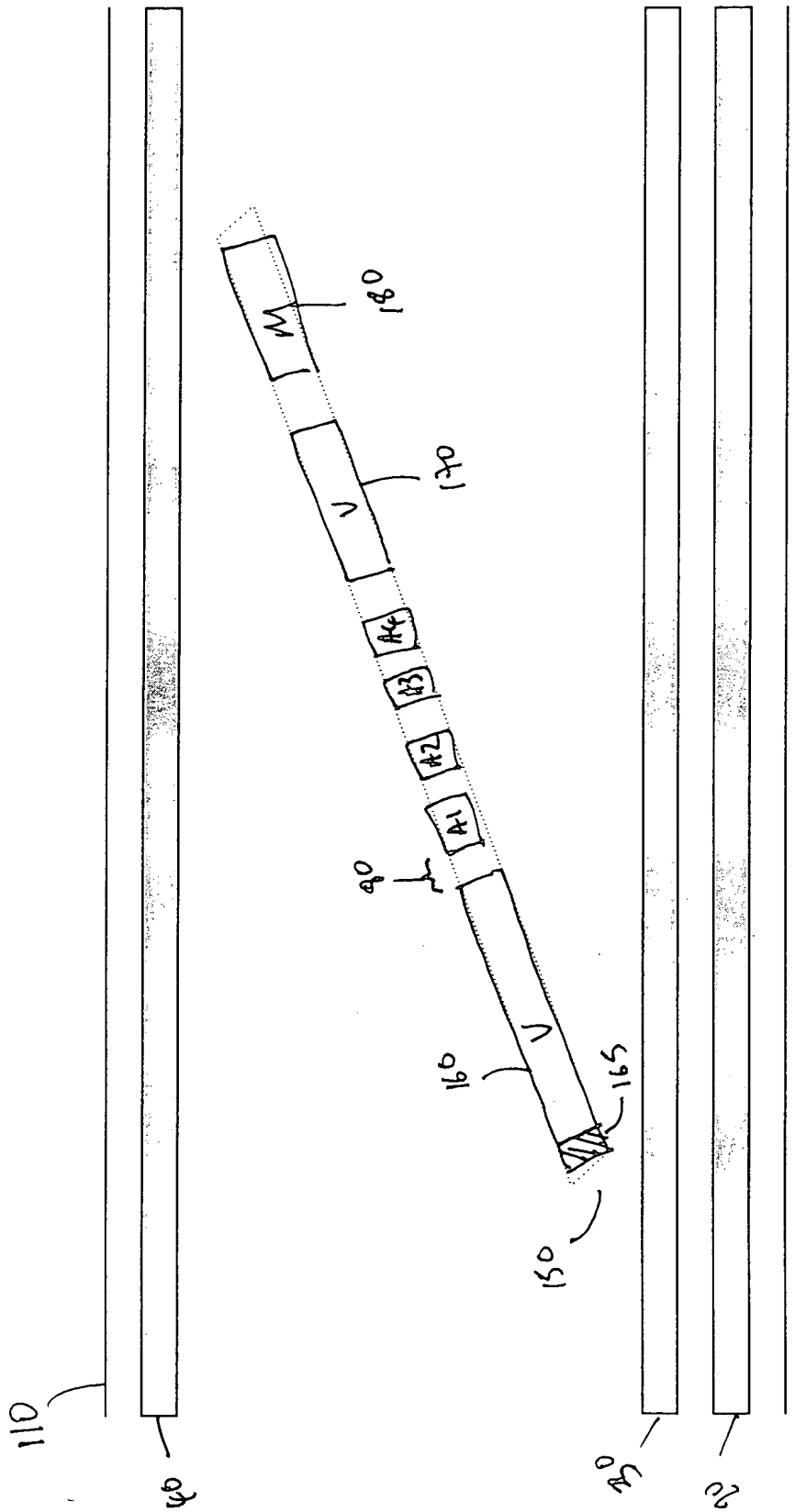

FIG. 2

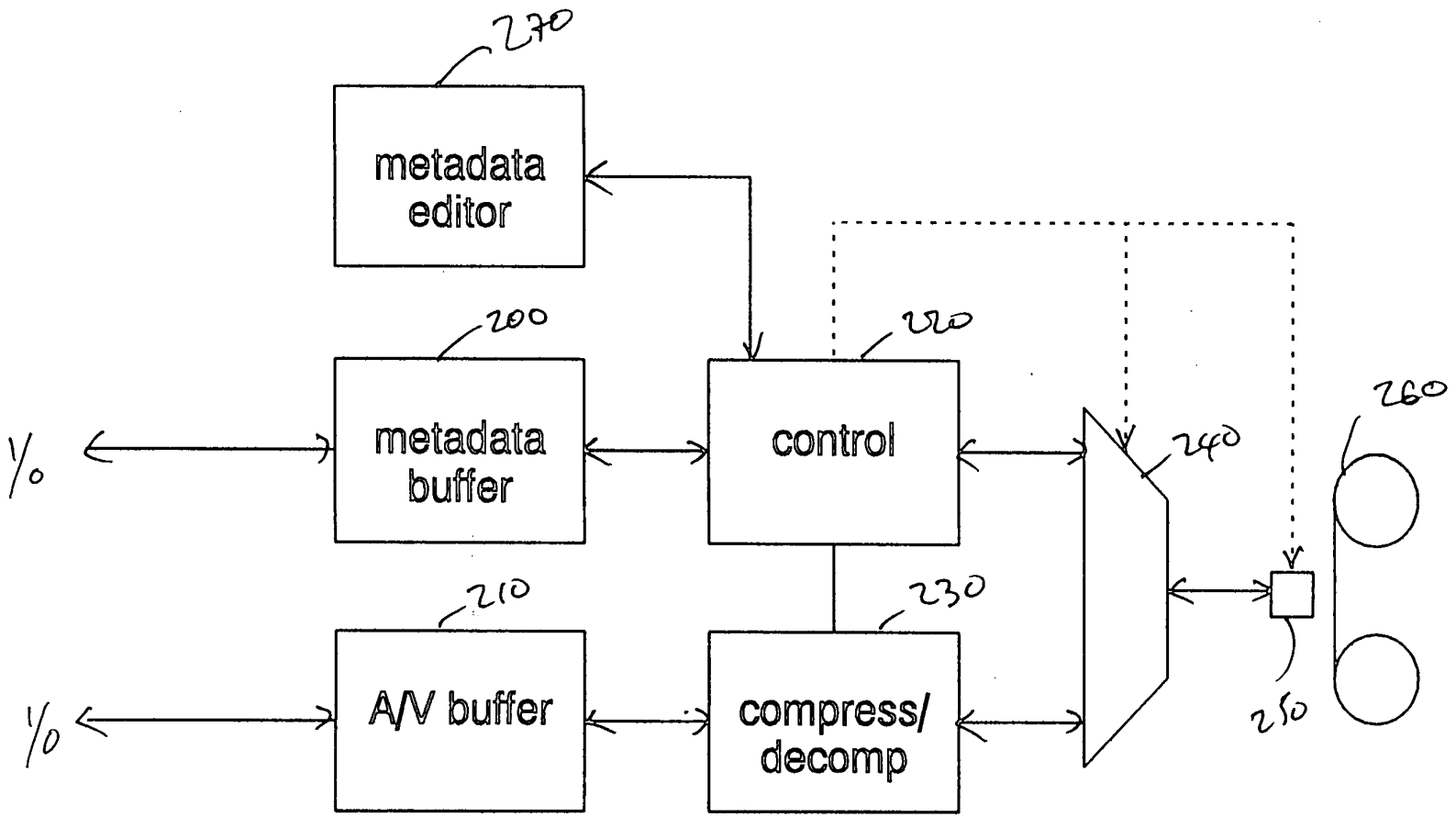
270
metadata editor
200
220
I/O
metadata buffer
control
240
260
210
230
I/O
A/V buffer
compress/ decomp
250

Fig. 3